Discovery Preproposal Conference

Technical, Management, and Cost (TMC) Evaluation

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AO Highlights - Standard Features

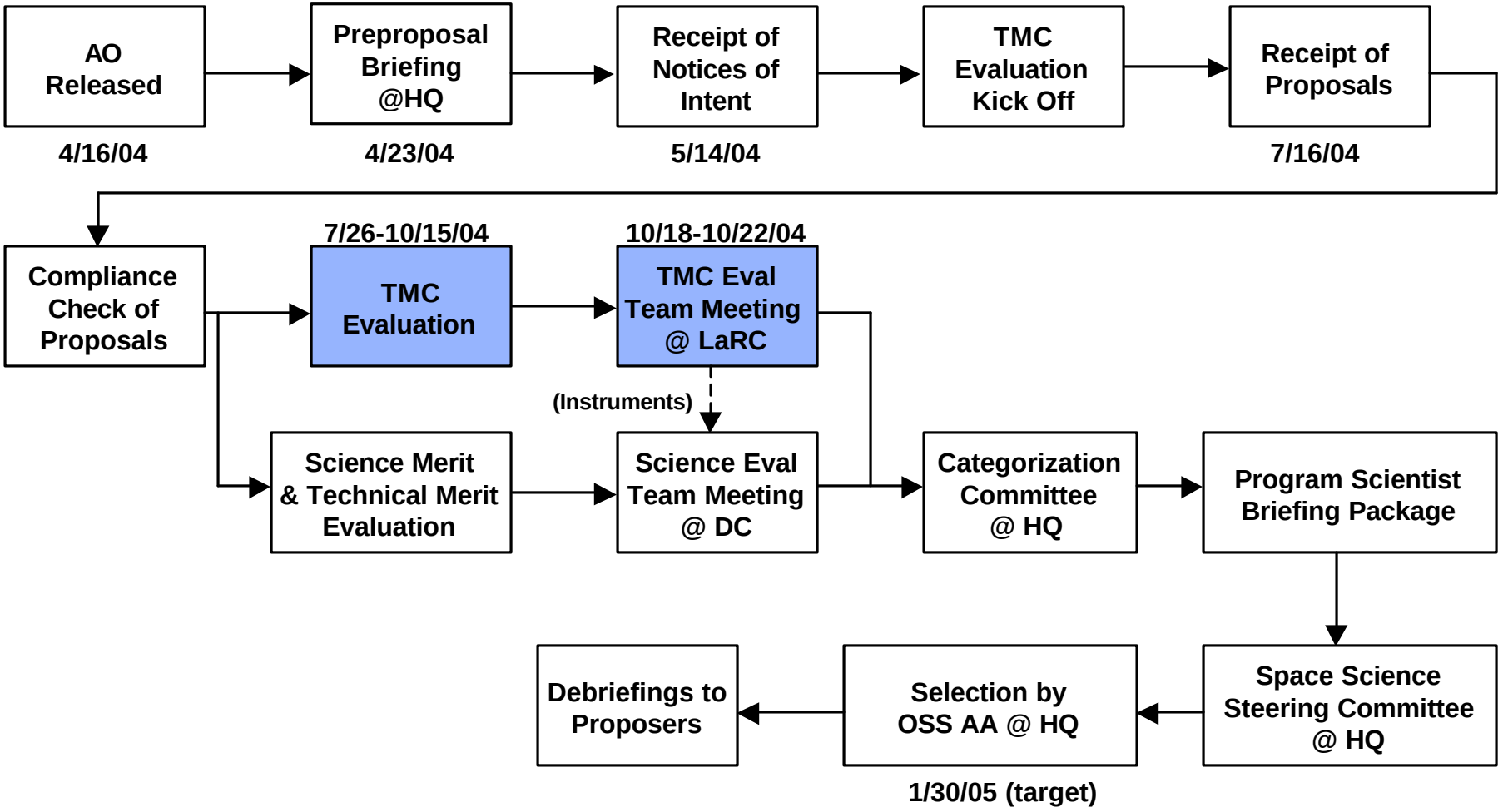
- Investigations are PI-led.
- Mission Investigations are for complete end-to-end efforts.
- Missions of Opportunity are for US investigations on a non-Office of Space Science (OSS) mission.
- ELV must either be NASA provided or contributed.
- Contributions are encouraged but limited to 1/3 of the total cost to OSS.
- No RTG's but limited quantities of nuclear material (RHU's) OK
- All Discovery investigation data is non-proprietary and must be entered in to the PDS and made available to the community.
- Proposed subcontracting plans and SDB participation targets for Discovery investigations will be evaluated for contracts over $500K.
- Proposer must provide commitment to carry out E/PO program and an overview of the E/PO activities.

AO Highlights
Unique to Discovery AO

- Full mission OSS Cost Cap: $360M FY 04
- Mission Launch date no later than December 31, 2009
- Selected mission investigation teams will be funded to perform a Phase A Concept Study of up to 6 months at a level up to $1M RY$

- Missions of Opportunity (MO) cost cap: $35M FY 04
- Mission of Opportunity must be part of mission launched no later than December 31, 2009 and require a commitment from NASA before December 31, 2005.
- If Concept Study is deemed necessary for an MO investigation funding will not exceed $250K RY$

Discovery Proposal Evaluation Process



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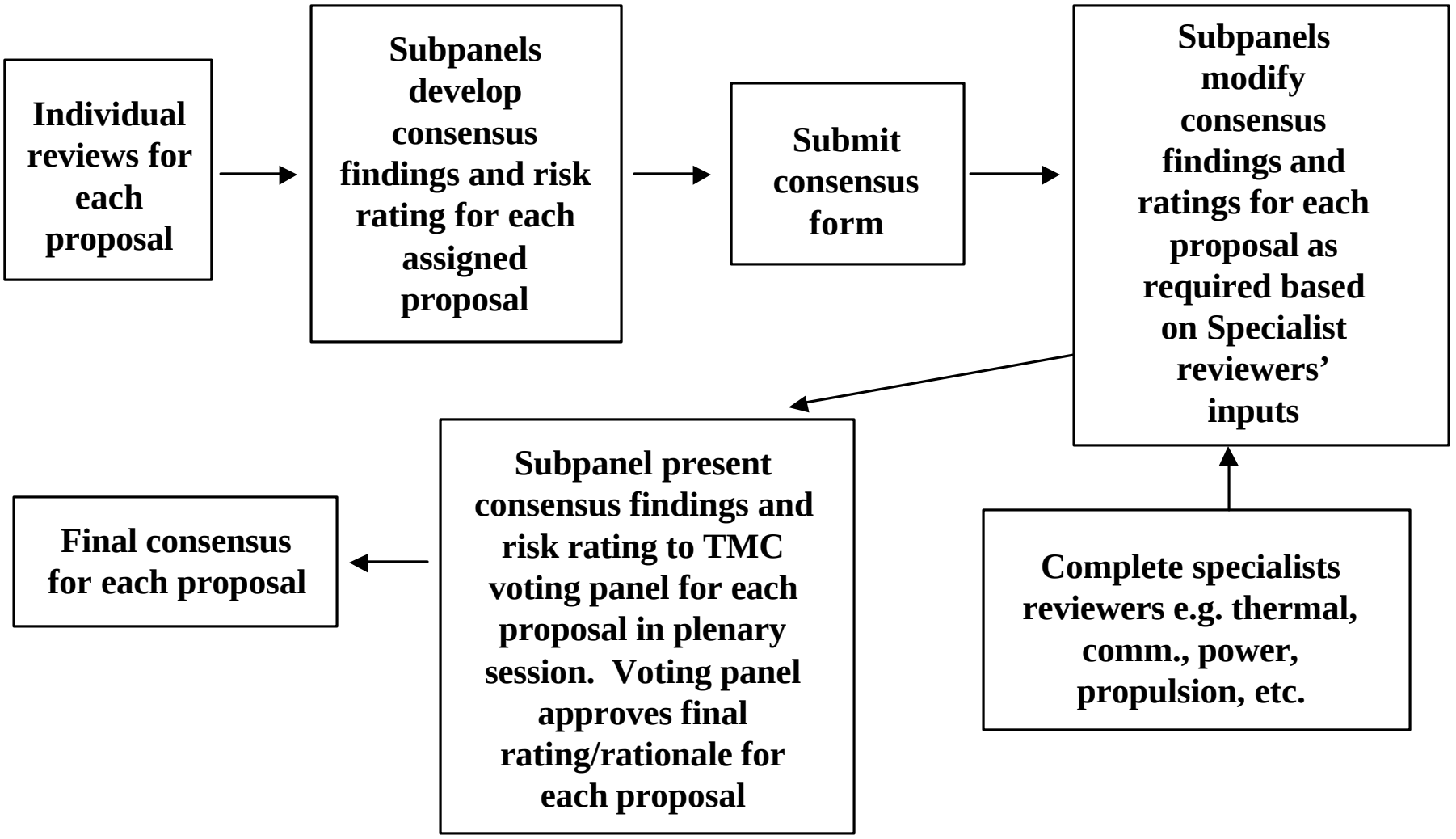
TMC Evaluation Flow



TMC Principles *for Discovery*

- **Basic Assumption**: Proposer is the expert on his/her proposal.
  - **TMC:** Task is to try to validate proposer's assertion of Low Risk.
  - **Proposer:** Task is to provide evidence that the project is Low Risk.

- **All Proposals will be reviewed to identical standards.**
  - ESSSO established in 1996 by OSS to support Discovery and Explorer, now also supports New Frontiers, OES, and others.
  - The TMC process is used by ESSSO to support all OSS evaluations with a standard process.
  - All proposals receive same evaluation treatment in all areas.

- **All evaluators will be experts in the area of expertise that they evaluate.**

- **TMC Findings will be the consensus of the entire TMC panel.**
  - Findings: As expected (no finding), above expectations (strengths), below expectations (weaknesses).

Discovery Defined from a TMC Perspective

- **Step One Proposal Risk Assessment:**
  - The TMC Risk Assessment is based on a *preliminary concept* with appropriate benefit of the doubt given to the Proposer.
  - The Cost Analysis is done without Proposer feedback and is integrated into overall risk.
- **Mission of Opportunity (MO) investigations will be evaluated using same criteria as full mission investigations**.

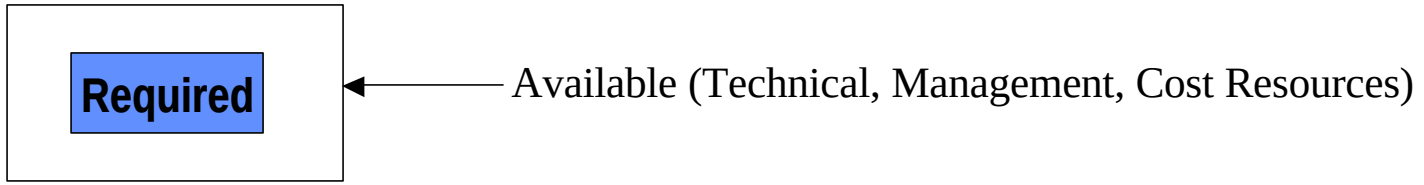
TMC Evaluation Objective

- **The TMC evaluation is to determine, for each Proposal, the level of risk of accomplishing the scientific objectives of the investigation, as proposed, on time and within cost.**
- **There are three possible Risk Levels: Low, Medium, and High**
  - **Low Risk:** There are no problems in the proposal that cannot be normally solved within the time and cost proposed. Problems are not of sufficient magnitude to doubt the Proposer's capability to accomplish the investigation.
  - **Medium Risk:** Problems have been identified, but are considered within the proposal team's capabilities to correct with good management and application of effective engineering resources. Mission design may be complex and resources tight.
  - **High Risk:** Problems are of sufficient magnitude such that failure is highly probable.

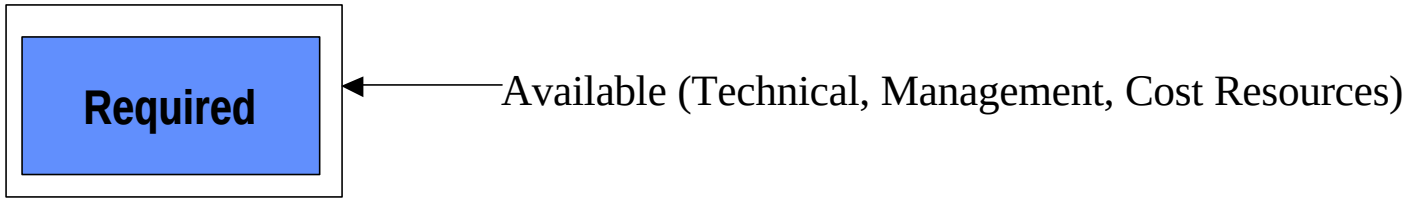
TMC Envelope Concept

Envelope: All TMC Resources available to handle known and unknown development problems that occur. Includes schedule and funding reserves; reserves and margins on physical resources such as mass, power, and data; descope options; fallback plans; and personnel.

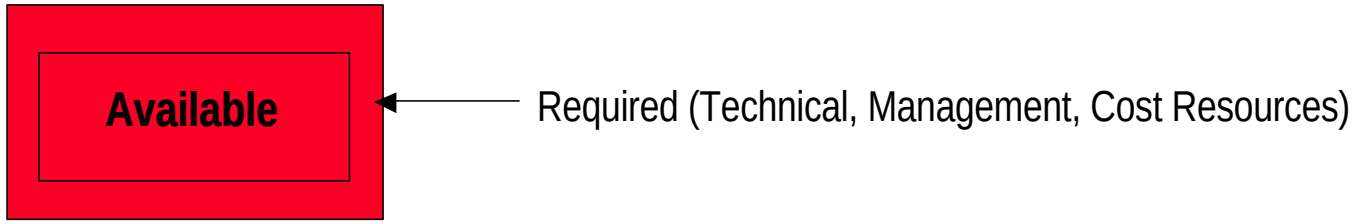
Low Risk: Required resources fit well within available resources



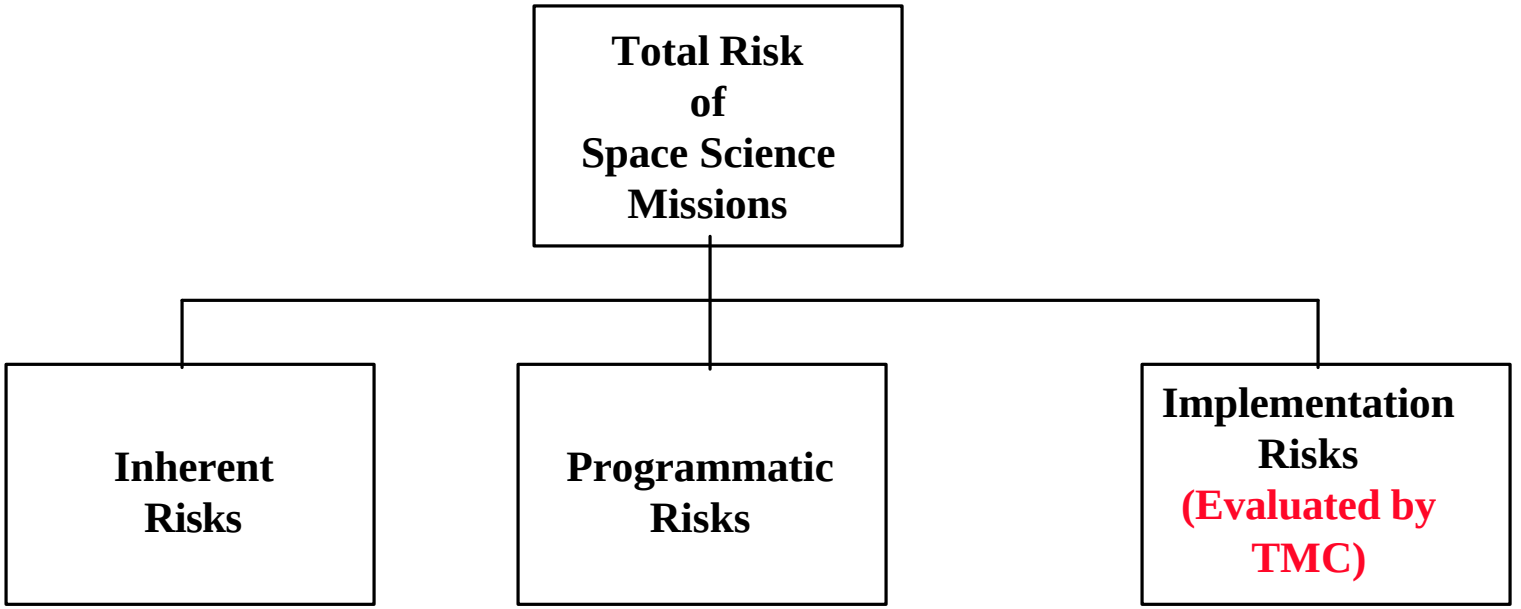
Medium Risk: Required resources just barely inside available resources. Tight, but likely doable



High Risk: Required resources DO NOT fit inside available resources. Expect project to fail



Risks for Space Science Missions



Risks that are unavoidable to do the investigation:

- Launch environments
- Space environments
- Mission durations
- Technologies or technology extensions
- Unknowns
- Etc.

Risks that are uncertainties due to matters beyond project control:

- Environmental Assessment approvals
- Budgetary uncertainties
- Political impacts
- Etc.

Risks that are associated with implementing the investigation:

- Adequacy of planning
- Adequacy of management
- Adequacy of development approach
- Adequacy of schedule
- Adequacy of funding
- Adequacy of Risk Management (planning for known & unknown)

TMC Evaluation Considerations for Discovery Mission Investigation Proposals

Generally, the degree to which Proposals address the following factors directly relates to the grade of Low, Medium, or High Risk:

- **Mission Design and Launch Vehicle**
  - Launch Mass Margin
  - Trajectory Analysis
  - Launch Services
- **Flight System**
  - Hardware/Software Design
  - Design Heritage
  - Systems Engineering
  - Design Margins (Excluding Launch mass)
  - Qualification & Verification
  - Instrument accommodations and resources
- **Ground System**
  - Concept of Operations
  - Team Experience
  - Ground Facilities – New/Existing
  - Telecom
- **Management, Organization, and Schedule**
  - Roles & Responsibilities
  - Organizational Structure & Work Breakdown Schedule (WBS)
  - Risk Management, Including Descope Plan & Decision Milestones
  - Project-level Schedule
- **Cost**
  - Basis of Estimate (BOE)
  - Cost Realism & Completeness
  - Cost Reserves by Phase
  - Comparison with TMC Estimates (Including Parametric Models/Analogies)

Note: For MO's, NASA will evaluate only the portions of the investigation that are funded by NASA.

Evaluation Criteria Feasibility of Proposed Approach for Mission Implementation

- The technical and management approaches of all submitted investigations will be evaluated to assess the likelihood they can be implemented as proposed, including an assessment of the risk of their completion within the proposed cost.
- The assessment also includes the adequacy of the proposed organizational structure, the roles and experience of known partners, the management approach, the commitments of partners and contributors and the team's understanding the scope of work.
- The relationship of the work to the project schedule, the project element interdependencies, and associated schedule margins will also be evaluated.
- Investigations proposing new technology will be penalized for risk if adequate backup plans to ensure success of the mission are not described.
- Proposal must discuss methods and rationale used to develop the estimated cost, and must include a discussion of cost risks.
- Proposals that are unable to show an unencumbered reserve at the end of Phase B of at least 25% of all development costs (less ELV) are likely to be judged high risk.
- This evaluation results in a narrative text, as well as an appropriate risk rating.

Cost Evaluation

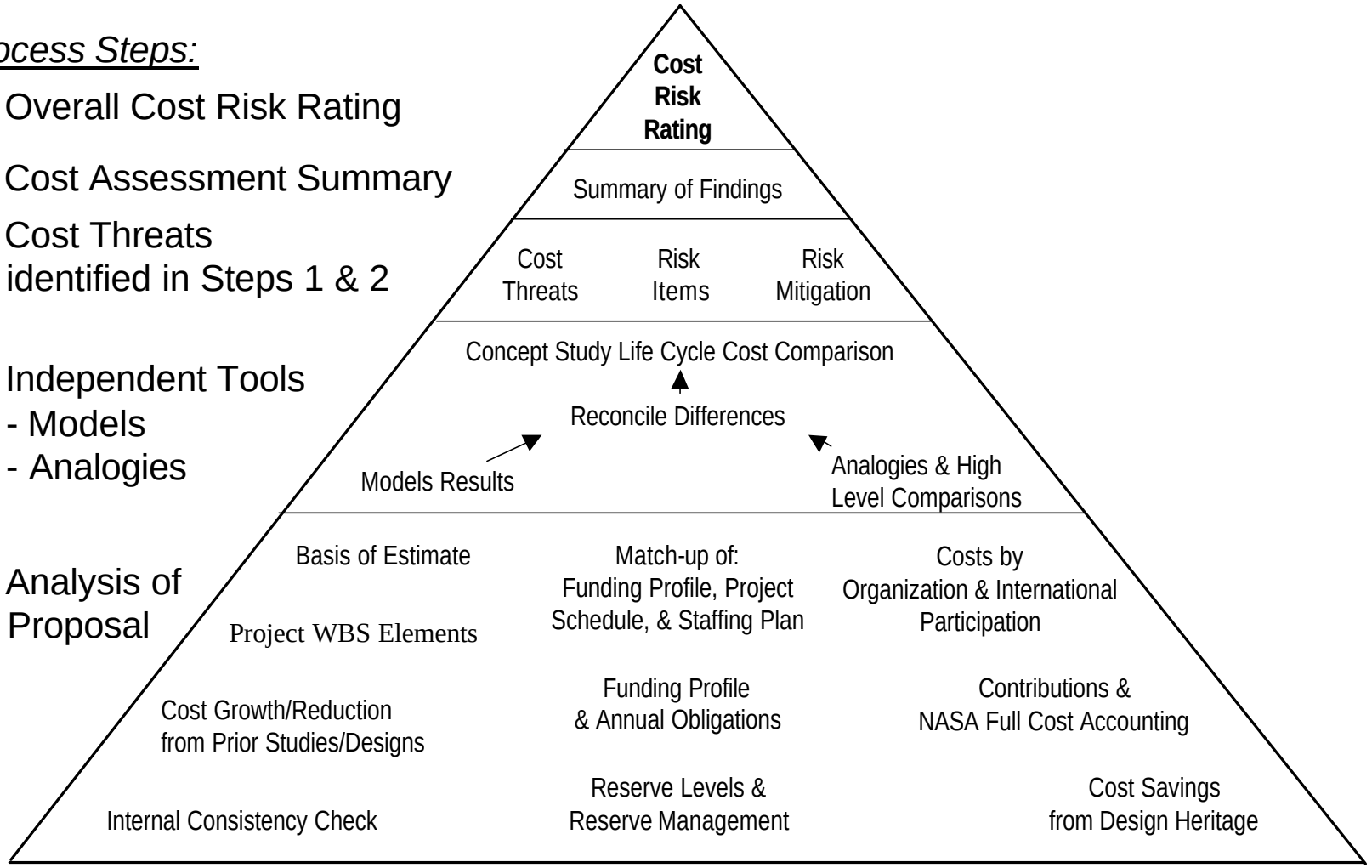
- Cost Realism is evaluated; however, a “should cost” or “Government cost estimate” is not reported to Proposers.
- Cost Realism is only reported as a Cost Risk (Low, Medium, High); based on Models, Analogies, Heritage, and Grass Roots information from Proposals.
- An initial cost analysis is accomplished based on information in the Proposals (consistency, completeness, proposed basis of estimate, contributions, use full cost accounting, maintenance of reserve levels, and cost management, etc.).
- Several independent cost models will be used to analyze proposed cost.
- The cost threats, risks, and risk mitigation analysis will be analyzed.
- All information from the entire Evaluation Process provides a final assessment.

TMC Independent Cost Assessment Pyramid

"The Pyramid"

Process Steps:

5. Overall Cost Risk Rating
4. Cost Assessment Summary
3. Cost Threats identified in Steps 1 & 2
2. Independent Tools
   - Models
   - Analogies
1. Analysis of Proposal



Typical TMC Evaluation Questions to be Answered

Will overall investigation approach allow successful implementation as proposed? If not, are there sufficient resources (time & $) to correct identified problems?

Does proposed design/development allow the investigation to have a reasonable probability of accomplishing its objectives and include all needed tools? Does it depend on new development that has not yet been flight qualified? Are requirements within existing capabilities or are advances required? Does the proposal accommodate sufficient resiliency in appropriate resources (e.g., money, mass, power) to accommodate development uncertainties?

Is there a Risk Management approach adequate to identify problems with sufficient warning to allow for mitigation without impacting the investigation's objectives? Does the proposer understand their known risks and are there adequate fallback plans to mitigate them, including risk of using new developments, to assure that investigation can be completed as proposed?

Typical TMC Evaluation Questions to be Answered (cont'd)

Is the schedule doable? Does it reflect an understanding of work to be done and time it takes to do it? Is there a reasonable probability of delivering the investigation on time to meet Discovery Project Schedules? Does it include schedule margin?

Will proposed management approach (e.g., institutions and personnel, as known, organization, roles and responsibilities, experience, commitment, performance measurement tools, decision process, etc) allow successful completion of investigation? Is the PI in charge?

Does the investigation, as proposed, have a reasonable chance of being accomplished within proposed cost? Are proposed costs within appropriate caps and profiles and does cost estimate cover all costs including full-cost accounting for NASA Centers? Are costs phased reasonably? Is there evidence in the proposal to give confidence in the proposed cost? Does the proposer recognize all potential risks/threats for additional costs or cost growth (e.g., added costs of failed developments, late deliveries of components, etc)?

Some Characteristics
Applicable to a Low Risk Rating

- All risks for the project have been/are being identified and managed by the team, with plans to reduce or retire the risk before launch.
- No risk exists for which there is neither a workaround planned, nor a very sound plan to develop and qualify the risk item for flight.
- The proposed project team and each of its critical participants are competent, qualified, and committed to execute the project.
- The project will be self managed to a successful conclusion while providing reasonable visibility to NASA for oversight.
- The team has thoroughly analyzed all project requirements, and the resulting resources proposed are adequate to cover the projected needs, including an additional percentage for growth during the design and development, and then a margin on top of that for unforeseen difficulties.
- Reserve time exists in the schedule to find and fix problems if things do not go according to plan.
- Any contributed assets for the project are backed by letters of commitment.
- The team understands the seriousness of failing to meet technical, schedule, or cost commitments for the project in today's environment.

Draft Discovery Downselect Schedule/Evaluation Flow